Promoting Clinical Involvement in Hospital Quality Improvement Efforts: The Effects of Top Management, Board, and Physician Leadership

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Study Question. An examination of the effects of top management, board, and physician leadership for quality on the extent of clinical involvement in hospital CQI/TQM efforts.

Data Sources. A sample of 2,193 acute care community hospitals, created by merging data from a 1989 national survey on hospital governance and a 1993 national survey on hospital quality improvement efforts.

Study Design. Hypotheses were tested using Heckman's two-stage modeling approach. Four dimensions of clinical involvement in CQI/TQM were examined: physician participation in formal QI training, physician participation in QI teams, clinical departments with formally organized QA/QI project teams, and clinical conditions and procedures for which quality of care data are used by formally organized QA/QI project teams. Leadership measures included CEO involvement in CQI/TQM, board quality monitoring, board activity in quality improvement, active-staff physician involvement in governance, and physician-at-large involvement in governance. Relevant control variables were included in the analysis.

Principal Findings. Measures of top management leadership for quality and board leadership for quality showed significant, positive relationships with measures of clinical involvement in CQI/TQM. Active-staff physician involvement in governance showed positive, significant relationships with clinical involvement measures, while physician-at-large involvement in governance showed significant, negative relationships.

Conclusions. Study results suggest that leadership from the top promotes clinical involvement in CQI/TQM. Further, results indicate that leadership for quality in healthcare settings may issue from several sources, including managers, boards, and physician leaders.

Key Words. Total quality management, continuous quality improvement, leadership, clinical quality improvement, governance

It is widely believed that the systematic application of industrial quality improvement (QI) methods can result in significant improvement in clinical processes and medical care outcomes (Berwick, Godfrey, and Roessner 1990; Berwick 1989; James 1989; Laffel and Blumenthal 1989). Reports suggest, however, that hospital leaders intentionally narrow the focus of QI efforts to business or service processes to avoid the appearance of management encroachment on physician autonomy in clinical decision making (Berwick, Godfrey, and Roessner 1990; *Quality Review Bulletin* 1992). This tactical approach is consistent with the view that QI projects directed at physician practice patterns and utilization should be run by and for physicians (Kralovec 1990). Yet reports also indicate that hospital leaders confront substantial barriers to cultivating clinical involvement in QI projects (Health Care Advisory Board 1992; Merry 1990; McLaughlin and Kaluzny 1990). Physicians are apparently reluctant to participate in QI projects due to distrust of hospital motives, lack of time, and fear that reducing variation in clinical processes will compromise their ability to vary care to meet individual patients' needs (Blumenthal and Edwards 1995; Shortell, O'Brien, Carman, et al. 1995a). Thus, low clinical involvement in QI efforts seems to be due as much to management's reluctance to recruit physicians as to physicians' reluctance to participate.

Low clinical involvement rates are unfortunate, for it is precisely in the application of industrial QI methods to clinical processes that the greatest impact can be made on healthcare costs, quality, and outcomes. Given the central role that clinical personnel play in resource allocation decisions, hospital leaders will have to devise strategies to increase clinical involvement in QI if they wish to realize the full benefits of this new approach (Blumenthal and Edwards 1995; Shortell, O'Brien, Carman, et al. 1995a). In industrial settings, leadership from the top seems to be a critical factor for overcoming the skepticism and reluctance of organizational process owners and middle managers (Deming 1986; Ishikawa 1985; Juran 1988, 1989). We extend this

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idea to healthcare settings by examining the following research questions: Does leadership for quality promote clinical involvement in hospital QI efforts? If so, what roles do top management, boards, and physician leaders play in promoting clinical involvement?

CONCEPTUAL FRAMEWORK

Industrial QI approaches travel under a variety of acronyms and encompass a wide range of philosophies, principles, and methods. In this study, continuous quality improvement (CQI) is defined as an ongoing effort to provide care that meets or exceeds customer expectations. Total quality management (TQM) is defined as a structured process for creating organization-wide participation in planning and implementing continuous improvement. CQI/TQM combines the application of statistical tools and scientific investigation with the organization's knowledge of work processes and customer requirements (Shortell, O'Brien, Carman, et al. 1995b). This approach differs significantly from quality assurance (QA), wherein quality is defined as adherence to acceptable standards of patient care, behavior of individual providers is subject to retrospective peer review, and corrective or disciplinary action is taken when necessary (Weiner and Alexander 1993).

Clinical involvement in CQI/TQM can be viewed as a multidimensional construct indicating not only physician activity in QI, but also clinical department activity in QI and use of quality of care data by QI project teams. Physician activity is often discussed in terms of participation in formal QI training or QI project teams (Shortell, O'Brien, Carman, et al. 1995a; Blumenthal and Edwards 1995). The former reflects the hospital's preparation for or investment in clinical quality improvement, while the latter gauges actual physician involvement in QI efforts. Clinical department activity in QI indicates organization-wide participation in CQI/TQM as opposed to individual physician participation. Finally, use of quality of care data by QI project teams signals commitment of clinical time and resources, since clinical personnel are needed to map clinical pathways, interpret results of QI studies, and devise corrective or improvement strategies.

Leadership from the top is often cited as a critical determinant of successful QI implementation (Deming 1986; Ishikawa 1985; Juran 1988, 1989). Only senior leadership, it is argued, can establish quality as top priority, create a corporate culture for quality, and mobilize the financial and human resources necessary to support organizational learning. The importance of

high-level leadership may be especially critical in cultivating clinical involvement in CQI/TQM. As Blumenthal and Edwards (1995) observe, healthcare managers often lack direct control over the incentives and work conditions that affect physician behavior. Even when they are employed by healthcare organizations, physicians possess a unique body of knowledge that confers a certain measure of autonomy in clinical decision making. Given the special status of physicians in healthcare organizations, healthcare managers cannot depend on traditional management structures and controls to secure physician participation in CQI/TQM. By demonstrating personal, visible leadership for quality, however, managers can lower physician skepticism about management's commitment to quality medical care and overcome the fear of surveillance and "make work" that clinicians often associate with traditional quality assurance activities (Berwick, Godfrey, and Roessner 1990). Further, leadership from the top may be crucial for breaking down departmental and professional barriers that impede the efforts of cross-functional teams to address clinical cost and quality issues.

In industrial settings, top management assumes responsibility for demonstrating leadership for quality. However, many healthcare organizations possess a more diffuse leadership structure due to the presence of an organized body of professionals who are not employees and a broader set of stakeholder accountabilities due to public or tax-exempt status. Although a diffuse leadership structure may not lessen the importance of top management leadership, it suggests the possibility that leadership for quality in healthcare may come from other sources, including boards of directors and physician leaders.

TOP MANAGEMENT LEADERSHIP FOR QUALITY

Although physicians are often economically and organizationally independent of the hospital, they are nonetheless sensitive to the messages that are communicated by hospital management (Blumenthal and Edwards 1995; Shortell 1991). Physicians may respond more positively to CQI/TQM when senior managers demonstrate through words and deeds that the hospital is committed to providing high-quality medical care. By leading through example, senior managers build credibility and trust with clinical staff, which in turn, may spur greater clinical involvement in CQI/TQM. Further, by creating a corporate culture for quality, senior managers may encourage clinical staff to initiate or participate in quality improvement projects.

Hypothesis 1. The greater the degree of CEO leadership for quality, the greater the degree of clinical involvement in CQI/TQM.

BOARD LEADERSHIP FOR QUALITY

The hospital board also plays an important role in creating a corporate culture for quality (Arrington, Gautam, and McCabe 1995; Weiner and Alexander 1993). As the organizational entity legally held accountable for quality of care, the board is ultimately responsible for developing and overseeing quality improvement. More important, however, is the board's position as a nexus for planning, implementing, and institutionalizing the hospital's CQI/TQM effort. The board is often the only structural interface through which elements of hospital (and community) leadership can jointly establish, communicate, and evaluate a quality vision. This favorable position offers the board considerable leverage to build clinical involvement in CQI/TQM. For example, the board can enhance the credibility of the CQI/TQM effort by linking it to the organization's mission and strategic objectives, allocating financial resources for CQI/TQM, revising executive compensation and performance evaluation criteria, and playing an active role in quality control.

The board can also play a key role in promoting clinical involvement in CQI/TQM by maintaining "continuity of purpose" in situations of executive turnover (Blumenthal and Edwards 1995; *Quality Review Bulletin* 1992). CQI/TQM takes several years to yield significant cost savings and measurable quality improvement (Deming 1986; Juran 1988, 1989). Given the importance of both leadership from the top and constancy of purpose, executive turnover represents a serious challenge. A defining feature of the hospital board, however, is its stability (Starkweather 1988). Active board involvement in CQI/TQM increases the likelihood that the hospital's quality focus will remain constant even in the absence of stability in executive positions (Weiner and Alexander 1993). Steady, visible board leadership creates a climate of trust and assures staff and physicians of the hospital's unwavering commitment to CQI/TQM.

Hypothesis 2. The greater the degree of board leadership for quality, the greater the degree of clinical involvement in CQI/TQM.

PHYSICIAN LEADERSHIP FOR QUALITY

Reports suggest that physician leadership is a key factor influencing clinical acceptance and involvement in CQI/TQM (Berwick, Godfrey, and Roessner 1990; Shortell, O'Brien, Carman, et al. 1995a; Blumenthal and Edwards 1995). By training physician leaders early and involving them from the beginning, hospital leaders can instill a sense of physician ownership of the CQI/TQM effort. One way in which physicians may exercise leadership

for quality is by participating in strategic planning, policymaking, and related governance activities. Through involvement in governance, physician leaders can shape the hospital's quality vision and directly influence decisions about implementation and cost-quality trade-offs. Physician involvement in governance may not only improve communication among physicians, managers, and boards, but may also build trust by assuring clinical staff that their professional values and goals are represented in policy decisions (Shortell 1991; Rehm and Alexander 1986). Hence, involvement in governance by physician leaders may increase the receptivity and involvement of clinical staff in hospital CQI/TQM efforts.

Hypothesis 3. The greater the degree of physician involvement in governance, the greater the degree of clinical involvement in CQI/TQM.

Isolating the effects of leadership for quality on clinical involvement in CQI/TQM requires that we consider the potential confounding effects of several hospital and market characteristics. Research shows that physician involvement in governance, for example, varies as a function of hospital size, hospital performance, teaching status, multihospital system membership, ownership type, and market competition (Alexander and Morlock 1985; Alexander, Morlock, and Gifford 1988). Further, studies show that these context factors also influence CQI/TQM adoption and physician participation in CQI/TQM (Barsness, Shortell, Gillies, et al. 1993; Shortell, O'Brien, Carman, et al. 1995a). Hence, we incorporate these factors as control variables to rule out plausible alternative explanations about the relationship between leadership for quality and clinical involvement in CQI/TQM.

METHODS

Data were obtained from two national mailed surveys of U.S. community hospitals sent by the American Hospital Association and the Hospital Research and Educational Trust. The first supplied data on board composition. Mailed in 1989, the survey was completed by the CEO and key board members such as the board chairperson. The second provided data on hospital quality improvement efforts. Mailed in 1993, the survey was completed by the CEO and the person responsible for the hospital's overall QI effort. Response rates were approximately the same (60 percent, or 3,200 hospitals), with 2,193 hospitals responding to both surveys. These common respondents formed the study group. The four-year lag between surveys was not expected to

influence study results since board composition changes little over time (Alexander 1990; Alexander, Fennell, and Halpern 1993; Starkweather 1988). The analytic sample was reduced to 1,870 hospitals due to case deletion for missing data. Compared to the population of U.S. community hospitals, the analytic sample overrepresented larger hospitals, underrepresented investor-owned hospitals, and underrepresented teaching hospitals. There were no significant differences for multihospital system membership, urban location, or census region.

Merged with the survey file were data from the 1989 AHA Annual Survey of Hospitals and 1988–1989 Medicare Cost Report. The former supplied data on hospital size, hospital ownership type, multihospital system membership, teaching hospital status, and market competition. The latter furnished data on hospital financial performance.

DEPENDENT VARIABLES

Clinical involvement in CQI/TQM was measured by four variables: (1) *percentage of active staff physicians participating in formal QI training,* (2) *percentage of active staff physicians participating in QI teams,* (3) *percentage of clinical departments with formally organized QA/QI projects,* and (4) *percentage of conditions or procedures for which quality of care data are used by formally organized QA/QI project teams.* A QA/QI project was defined as an organized effort on the part of three or more individuals with a designated team leader or facilitator to resolve a specific problem or undertake activities to improve upon current practices that *goes beyond the routine daily operation* of the department or functional activity, or the normal responsibilities of a quality assurance committee. Nine clinical departments (e.g., emergency) were examined in the first measure. Fifteen clinical conditions or procedures (e.g., uncomplicated myocardial infarction) were examined in the second. The appendix provides the full list of departments and conditions examined in the study.

INDEPENDENT VARIABLES

Three sources of leadership for quality were studied: top management leadership for quality, board leadership for quality, and physician involvement in governance. Top management leadership for quality was measured as the number of CQI/TQM activities in which the CEO personally participated. *CEO participation in CQI/TQM* was captured by 13 possible activities (e.g., participating in the QI management council). The appendix provides the full list of activities.

Board leadership for quality was captured by board quality monitoring and board activity in quality improvement. *Board quality monitoring* was measured as the number of quality-related reports received by the board. Ten quality-related reports were studied (e.g., QI project results). The appendix provides the full list of reports. *Board activity in quality improvement* was measured as the number of actions taken by the board over the past 12 months to improve quality. Three board actions were examined: requesting that additional quality of care data be collected, initiating a special study of a specific quality problem, and taking corrective action on an identified problem. Both measures were constructed as additive scales.

Physician involvement in governance was measured by two variables: (1) *percentage of directors who were physicians with active clinical privileges at the hospital,* and (2) *percentage of directors who were physicians-at-large.*

CONTROL VARIABLES

Eleven additional characteristics were included to control for market and organizational factors related to CQI/TQM adoption, leadership for quality, or clinical involvement in CQI/TQM. First was the maturity of the hospital's CQI/TQM effort. *Time involved in CQI/TQM* was measured on a three-point scale indicating whether the CQI/TQM effort was less than two years old, two to four years old, or more than four years old.

Two dimensions of market context were studied. *Market competition* was measured by the inverse of the Herfindahl-Hirschman index (HHI), or the sum of the squared market shares for all hospitals in a market. Markets were defined by county lines. Market share was defined by the number of other hospitals in the focal hospital's market and the distribution of admissions among the focal hospital and its competitors. *HMO penetration* was measured by the number of HMOs operating in a hospital's market area.

The remaining control variables measured organizational characteristics shown to predict CQI/TQM adoption or clinical involvement in CQI/TQM. *Hospital size* was measured as the log transformation of the number of beds set up and staffed for use. *Multihospital system membership* was measured as a binary variable. A multihospital system was defined as two or more hospitals owned, leased, or sponsored by a separate administrative entity (Fennell and Alexander 1987). This definition excludes contract management. *Teaching status* was measured as a binary variable indicating membership in the Council of Teaching Hospitals (COTH). *Private ownership* was measured as a binary variable indicating that the hospital was private, not-for-profit or investor owned. Hospital performance was measured by cash flow and

adjusted admissions. *Cash flow,* measured as the ratio of net income and depreciation to total assets, captures the efficiency with which a hospital used its financial resources. *Adjusted admissions,* normalized by hospital size, reflects a hospital's ability to acquire a critical resource from the environment. Performance measures were constructed from two-year averages. *Managed care penetration* at the organizational level was measured as the percentage of cases for which the hospital was paid on a capitated, negotiated per case rate, or discounted basis (excluding Medicare and Medicaid).

ANALYTIC STRATEGY

Hypotheses were tested using the Heckman selection model (Kmenta 1986). This is a two-stage procedure that corrects for sample selection bias in regression analysis. Given that clinical involvement in CQI/TQM can occur only in hospitals that adopt CQI/TQM, selection bias may result if systematic differences between CQI/TQM adopters and nonadopters were significantly associated with predictors of clinical involvement in CQI/TQM.[1] For example, if hospital size were significantly associated with both CQI/TQM adoption and physician involvement in governance, then specification error would occur in a direct (i.e., single-stage) estimation of the effects of physician involvement in governance on clinical involvement in CQI/TQM. The Heckman two-stage model first estimates, using probit regression, the likelihood of CQI/TQM adoption for the full sample.[2] From this analysis, a selection bias parameter (lambda) is generated that summarizes information about the factors that influence CQI/TQM adoption. The selection bias parameter is then included as a control variable in a second-stage logistic regression analysis of clinical involvement in CQI/TQM.[3]

RESULTS

Descriptive statistics for all variables are shown in Table 1. Seventy percent of sample hospitals reported that their QI effort involved CQI/TQM. Of those engaged in CQI/TQM, 73.9 percent had been so for less than two years, 22.4 percent for two to four years, and 3.7 percent for more than four years. Eleven percent of active staff physicians at CQI/TQM hospitals had received formal QI training, but only 8 percent had participated in a QI project team. Slightly more than half of the clinical departments at CQI/TQM hospitals had formally organized QA/QI projects. However, project teams were using quality of care data to make specific improvements in only 18 percent of the conditions or procedures studied.

Table 1: Study Measures and Descriptive Statistics

Variable	*Description*	N	*Mean*	*s.d.*
Hospital Quality Effort				
Hospital involvement in CQI/TQM	Hospital has organized CQI/TQM effort (0 = no, 1 = yes)	2193	0.69	0.46
Clinical involvement in CQI/TQM	Percentage of clinical departments with formally organized QA/QI projects	2172	0.52	0.34
	Percentage of conditions/procedures for which quality of care data are used by formally organized QA/QI project teams	2137	0.18	0.26
	Percentage of physicians participating in formal QI training	1955	0.12	0.23
	Percentage of physicians participating in QI teams	1955	0.08	0.19
Leadership for Quality				
Physician involvement in governance	Percentage of directors who are active staff physicians	2163	0.15	0.15
	Percentage of directors who are physicians-at-large	2163	0.02	0.07
Board quality monitoring	Number of quality-related reports received by the board (range 0–10)	2154	6.60	2.10
Board activity in quality improvement	Number of quality improvement actions taken by the board in past 12 months (range 0–3)	2193	1.51	1.43
CEO involvement in CQI/TQM	Number of CQI/TQM activities in which CEO is personally involved (range 0–13)	1470	7.25	2.91
Control Variables				
Time involvement in CQI/TQM	Number of years involved in CQI/TQM (1 = <two years, 2 = two–four years, 3 = >four years	1499	1.29	0.53
Hospital performance	Cash flow (net income + depreciation/total assets)	2098	0.08	0.10
	Adjusted admissions (normalized by hospital size)	2126	44.33	17.00
Hospital size	Number of beds set up and staffed for use (natural logarithm)	2171	4.91	0.93
MHS member	Hospital owned, leased, or sponsored by a MHS (0 = no, 1 = yes)	2172	0.30	0.45
Teaching status	Hospital a member of Council of Teaching Hospitals (0 = no, 1 = yes)	2171	0.07	0.26
Private ownership	Hospital private, not-for-profit or investor-owned (0 = no, 1 = yes)	2171	0.73	0.26
Market concentration	Inverse of Herfindahl-Hirschman index (HHI) of market concentration based on total community hospital admissions in county	2188	0.51	0.45
HMO penetration	Number of HMOs in market	2193	4.73	7.32
Managed care penetration	Percentage of patients for which hospital is paid on a capitated, negotiated per case rate or discounted rate (excluding Medicare and Medicaid)	2193	0.20	0.29

Table 2 shows the effects of top management, board, and physician leadership for quality on clinical involvement in CQI/TQM.[4] The first column under each model heading reports simple, multivariate associations among analytic variables and outcomes of interest. The second column under each model heading offers a more complete view controlling for selection factors, hospital characteristics, and market context. In general, results are comparable across the column pairs. However, there is some evidence of both confounding and suppression effects, particularly for the two measures of physician participation in governance. Consequently, hypotheses were tested using the complete (i.e., second column) models containing both the leadership and control variables.

Results show that CEO involvement in CQI/TQM demonstrated a significant, positive relationship with three of the four clinical involvement measures: physician participation in formal QI training, clinical departments with formally organized QA/QI projects, and clinical conditions for which quality of care data are used by formally organized QA/QI project teams. Hence, results for top management leadership for quality generally supported Hypothesis 1.

Board quality monitoring demonstrated a significant, positive relationship with all four clinical involvement measures. Likewise, board activity in quality improvement showed a significant, positive relationship with three of the four clinical involvement measures: physician participation in formal QI training, physician participation in QI teams, and clinical conditions for which quality of care data are used by formally organized QA/QI project teams. Hence, results for board leadership for quality generally supported Hypothesis 2.

Active-staff physician involvement in governance showed a significant, positive relationship with all four clinical involvement measures. Yet physician-at-large involvement in governance displayed a significant, *negative* relationship with three clinical involvement measures: physician participation in formal QI training, clinical conditions for which quality of care data are used by formally organized QA/QI project teams, and clinical departments with formally organized QA/QI project teams. Hence, support for Hypothesis 3 depends on the type of physicians involved in governance.

Among the control variables, only length of time a hospital has been involved in CQI/TQM showed a consistent pattern of relationships with all four clinical involvement measures. Hospital size, private ownership, and multihospital system membership showed negative, significant relationships with physician participation in QI teams, yet showed positive (and often

Table 2: Logistic Regression Analysis of Physician Involvement in Governance, Board Leadership for Quality, and CEO Leadership for Quality on Clinical Involvement in CQI/TQM (Unstandardized Coefficients Reported)

Constructs	*Model 1*		*Model 2*		*Model 3*		*Model 4*	
Variables	*Physicians Participting in Formal QI Training* (N = *1121*)		*Physicians Participating on QI Teams* (N = *1121*)		*Clinical Departments with Formal QA/QI Teams* (N = *1225*)		*Clinical Data Used by Formal QA/QI Teams* (N = *1211*)	
Intercept	−2.98****	−5.55****	−4.02****	−1.77*	−0.57****	−6.55****	−2.77****	−10.77****
Top Management Leadership for Quality								
CEO involvement in CQI/TQM	−0.00	−0.00	0.03****	0.02****	0.04****	0.02**	0.07****	0.04****
Board Leadership for Quality								
Board quality monitoring	0.08****	0.06****	0.07****	0.06****	0.08****	0.05***	0.11****	0.10****
Board activity in CQI/TQM	−0.02**	0.05****	0.04****	0.08****	0.04*	0.03	0.12****	0.11****
Physician Participation in Governance								
Clinical MD representation on board	0.56****	1.20****	0.77****	0.44**	0.53****	1.02****	0.02	0,90****
MD-at-large representation on board	−0.87****	−1.55****	−0.42*	−0.50	−0.45	−2.97****	−0.25	−2.07**
Control Variables								
Time involved in CQI/TQM		0.19****		0.47****		0.50****		0.29****
Cash flow		−0.32**		0.25		0.66****		−0.33
Adjusted admissions		0.00		−0.01***		0.01***		0.02****
Hospital size		0.04		−0.42****		0.57****		0.73****
Private ownership		0.22****		0.28****		0.24**		0.36****
MHS membership		0.23****		−0.19**		0.44****		0.77****
Market competition		−0.63****		−0.52****		−0.13		−0.14
HMO penetration		0.00		0.01***		0.00*		0.01***
Capitation		0.01****		0.00		3.0E-3*		0.01****
Selection parameter		3.56****		0.48		3.11***		5.02****
c-statistic	0.52	0.61	0.57	0.64	0.57	0.61	0.60	0.63
Log-Likelihood chi-Square (d.f.)	648****	2654****	535****	2389****	169****	367****	320****	442****
(d.f)	(5)	(15)	(5)	(15)	(5)	(15)	(5)	(15)

* $p < .05$; ** $p < .01$; *** $p < .001$; **** $p < .0001$.

significant) relationships with the other clinical involvement measures. The organization-level measure of managed care penetration, the selection bias parameter summarizing information about CQI/TQM adoption factors, and the cash flow measure of hospital performance showed nonsignificant (or marginally significant) relationships with physician participation in QI teams, yet showed significant, positive relationships with the other three clinical involvement measures. We interpret this pattern of results in the discussion section.

DISCUSSION

Study results provide empirical support for our claim that leadership from the top promotes clinical involvement in CQI/TQM. This finding has considerable practical significance given the central role of clinical personnel in resource allocation decisions and the substantial barriers that hospital leaders confront in cultivating clinical involvement. As Berwick and his colleagues observe, the challenge of building clinical involvement in CQI/TQM is pervasive and troublesome for healthcare organizations:

> Institutions launching quality improvement programs almost always ask: How shall we involve doctors, who do not seem to see themselves as players in processes, whose financial incentives impede participation in project teams and data collection activities, and who do not strongly believe that their interests are tied to the improvement of the health care organizations they work in? In fact, barriers to physician involvement may turn out to be the most important single issue impeding the success of quality improvement in medical care. (Berwick, Godfrey, and Roessner 1990:151)

Beyond the difficulty of securing physician participation, hospital leaders seeking to reap the full benefits of CQI/TQM face the additional challenge of breaking down the departmental and professional barriers that frequently make it difficult for cross-functional teams to address clinical cost and quality issues.

Results suggest that leadership from the top is a key success factor in meeting these challenges. For example, hospital leaders can enhance the credibility (and sustainability) of the CQI/TQM effort by linking it to the organization's mission and strategic objectives, allocating financial and human resources for CQI/TQM, aligning compensation and performance appraisal systems to QI objectives, and demonstrating personal, visible commitment to continuous improvement. Further, hospital leaders can build physician participation in CQI/TQM by identifying different segments of physicians

(e.g., salaried hospital-based or group practice–based physicians, physicians with special interests in QI, or high-admitting physicians of high-cost, high-volume conditions) and targeting each with a specific strategy to increase the probability of involvement (Shortell, O'Brien, Carman, et al. 1995a). Physician leaders can be especially helpful in implementing this approach. Finally, hospital leaders can encourage cross-functional teamwork among health professionals by assigning budgets on clinical service lines rather than traditional departmental lines. While more research is needed, study results are consistent with these recommendations.

Study results also provide empirical support for our claim that leadership for quality in healthcare settings may issue from several sources including managers, boards, and physician leaders. This finding is significant because it suggests that health services researchers and healthcare providers need to broaden the concept of leadership from the top and, therefore, to modify the prescriptions that quality experts give to organizations in other industries. For example, the dual lines of authority found in many hospitals may require both senior managers and physician leaders to demonstrate personal, visible commitment to quality improvement. Similarly, strong board leadership may be crucial both for creating a corporate culture for quality and for sustaining "continuity of purpose," particularly in situations of executive turnover. While not examined in this study, nursing leadership may also play an important role in promoting clinical acceptance and involvement in CQI/TQM efforts.

Although study results generally supported our hypotheses, analysis revealed that active-staff physician involvement in governance and physician-at-large involvement in governance have opposite effects on clinical involvement in CQI/TQM. The study's first-stage probit analysis of CQI/TQM adoption (not shown) exhibited a similar pattern. Thus, the greater the physician-at-large involvement in governance, the lower the likelihood of hospital adoption of CQI/TQM *and* the lower the degree of clinical involvement in the hospital's CQI/TQM effort. These results suggest that physicians-at-large either favor more traditional methods for ensuring quality of care (e.g., quality assurance, utilization review, risk management) or have an agenda that does not rank the systematic application of industrial QI methods to clinical processes as a high priority. Even physician-at-large board members who actively support CQI/TQM may find it difficult to translate their involvement in governance into personal, visible leadership for quality. As outsiders, they may be less successful in cultivating clinical involvement in the hospital's CQI/TQM effort because they lack the opportunity to develop the trust and respect that is forged from strong personal relationships and day-to-day

contact. In sum, results suggest that hospital leaders should recognize that physician board members may differ systematically in their willingness or capability to encourage physicians and clinical staff to initiate and participate in clinical quality improvement projects. Involving the hospital's own physician leaders in strategic planning, policymaking, and other governance activities seems to be key.

The results for control variables were generally consistent with expectations except in the model of physician participation in QI teams. The reversal of signs for some control variables in this model may suggest a definitional dependency problem. Definitional dependency occurs when ratio-dependent variables share a common term with one or more independent variables (Freeman and Kronenfeld 1973). While built-in dependencies do not favor one sign or direction of association over another, measurement error in the common term can bias the estimates for variables sharing the common term, even resulting in a reversal of sign in the observed association. Strictly speaking, none of the ratio-dependent variables shared a common term with the independent variables in the study. However, hospital size showed a 0.65 correlation with total number of physicians at the hospital, the denominator component for the two physician participation ratios. Sensitivity analysis suggested that a correlation of this magnitude could result in a reversal of sign given a moderate level of measurement error. Unfortunately, little agreement exists about how to correct or minimize the problems associated with definitional dependency.[5] It is important to note, however, that the signs and significance levels of estimates for hypothesis-testing variables remained unchanged when hospital size was removed from the physician participation models.

There are several areas for future research. First, formal involvement in the hospital's strategic planning, policy making, and related governance activities represents only one avenue for physicians to choose in exercising leadership for quality. Physicians can also take a formal leadership role by becoming more involved in hospital management. Further, physicians can informally encourage and guide efforts to apply QI methods to clinical cost and quality issues by setting a personal example and recruiting peers to participate on QI project teams (Blumenthal and Edwards 1995; Shortell, O'Brien, Carman, et al. 1995a). Through in-depth case studies, future research might examine whether formal and informal physician leadership for quality play equally important roles in promoting clinical involvement and, if so, whether these two types of physician leadership demonstrate multiplicative effects.

Second, there is need for longitudinal research that can specify the causal directions of the statistical associations observed in this study. For example, does board quality monitoring promote clinical involvement in CQI/TQM, or does clinical involvement in CQI/TQM promote board quality monitoring?

Finally, research might examine the influence of leadership from the top on the dynamic aspects of clinical involvement in CQI/TQM. Healthcare organizations use diverse strategies to encourage clinical acceptance and participation in CQI/TQM (Shortell, O'Brien, Carman, et al. 1995a; Blumenthal and Edwards 1995). Some organizations train many clinical professionals at the outset, while others provide only just-in-time training for participants in QI project teams. Some attempt to focus clinical involvement in CQI/TQM on a few strategically important clinical issues. Others seek to build a "critical mass" of clinical professionals involved in a wide array of QI projects across the organization. Through more fine-grain analysis, research might explore how the extent, source, or style of leadership from the top affects the timing of clinical involvement in CQI/TQM or the strategy used to secure clinical participation.

APPENDIX

Number of clinical departments with formally organized QA/QI projects was measured using nine possible departments: (1) ambulatory surgery; (2) anesthesia; (3) clinical nursing, for example, bedside patient care units; (4) emergency department; (5) laboratory, including blood bank; (6) operating room; (7) outpatient services; (8) pharmacy; and (9) radiology.

Number of conditions or procedures for which quality of care data are used by formally organized QA/QI project teams was measured using 15 possible conditions or procedures: (1) uncomplicated myocardial infarction (MI), (2) angioplasty, (3) pulmonary embolism, (4) congestive heart failure, (5) pneumonia, (6) hip replacement, (7) cholecystectomy, (8) transurethral resection of prostate, (9) coronary bypass, (10) perioperative MI, (11) cesarean section, (12) hysterectomy, (13) asthma, (14) diabetes, (15) congestive heart failure (outpatient).

CEO participation in CQI/TQM activities was measured using 13 possible activity domains: (1) participating in the quality improvement management council or steering committee; (2) teaching CQI/TQM to others; (3) participating on quality improvement teams; (4) using CQI/TQM methods in

working with senior management and administrative support staff; (5) using CQI/TQM methods in working with secretary and/or other administrative support staff; (6) participation in organization-wide improvement work with suppliers and customers; (7) regularly reporting the results of CQI/TQM activities to the organization's board; (8) helping collect and/or analyze data; (9) using CQI/TQM techniques in doing strategic planning; (10) revising the organization's statement of mission and philosophy to reflect CQI/TQM emphasis; (11) setting quality improvement goals for the organization; (12) applying CQI/TQM philosophy, principles, and methods to professional life; (13) applying CQI/TQM philosophy, principles, and methods to personal life.

Board quality monitoring was measured in terms of ten quality-related reports: (1) overall mortality rates not adjusted for severity of illness, (2) overall mortality rates adjusted for severity of illness, (3) condition-specific mortality rates adjusted for severity of illness, (4) infection rates, (5) medication error rates, (6) results of special studies, (7) results of quality improvement project teams, (8) results of patient satisfaction studies, (9) unscheduled readmissions to hospital or treatment unit within hosptial, and (10) other critical incident or adverse event data (e.g., patient falls).

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NOTES

1. The Heckman model views sample selection bias as a specification error or "omitted variables" bias that results when data are non-randomly missing. Assume that a potential observation is observed if $x_1 \beta_1 + u_1 > 0$, where u_1 has a standard normal distribution. For observations that meet this criterion, there is another regression equation, $y = x_2 \beta_2 x + \sigma u_2$, where u_2 also has a standard normal distribution but is potentially correlated with u_1 with correlation ρ. When ρ is significantly different from zero, standard regression techniques applied to the second equation yield biased results. In other words, if the error terms in both equations contain some common omitted variables, selection bias will occur. The Heckman procedure estimates values for the omitted variables from a first-stage model of the probability

of entry into the selected sample (e.g., CQI/TQM adoption). These estimated values are then used as regressors in a second-stage model in order to obtain consistent, asymptotically efficient estimates for the parameters of interest (e.g., the effects of leadership for quality on clinical involvement in CQI/TQM).

2. A hospital was classified as a CQI/TQM adopter only if its quality effort incorporated all five of the following components: (1) philosophy of continuous improvement of quality through improvement of work processes; (2) use of structured problem-solving processes incorporating statistical methods and measurement to diagnose problems and monitor progress; (3) use of QI teams including employees from multiple departments and different organizational levels as the major mechanism for introducing improvements in organizational processes; (4) empowering employees to identify quality problems and improvement opportunities and to take action on these problems and opportunities; and (5) explicit focus on "customers," both internal and external.
3. We employed logistic regression because the numerator component of the ratio-dependent variables is expressed as a discrete event (e.g., a physician either participated or did not participate in formal QI training). See Dobson (1990) for details. Factor analysis did not support construction of a single clinical involvement scale. Hence, each clinical involvement measure was examined separately.
4. Confidence intervals are available from the authors.
5. We tried several alternative modeling strategies including regressing only the numerator components on the independent variables. However, the severe positive skew of numerator components violated regression assumptions of normality and could not be corrected through algebraic transformation.

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